

Laser-based Standoff Methane Detectors

ARPA-E WORKSHOP: Ubiquitous Methane Leak Detection through Novel Sensors and Sensing Platforms

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PSI Company Overview

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PSI does:

- Applied research and development for all major agencies of the U.S. government
- Technology transition and product development for government and industrial customers
- Prototyping for commercial applications
- Production of specialized systems and components for DoD markets
- Licensing to strategic partners and spin-outs

PSI is:

- A 38 year-old company of 180 scientists, engineers, and administrative personnel
- Headquartered in Andover, MA,; additional R&D operations in Pleasanton, CA
- Employee-owned via the PSI Employee Stock Trust
- Subsidiaries:
 - **Q-Peak** (Bedford, MA) manufactures lasers and optical devices
 - **Research Support Instruments** (Lanham, MD; Princeton, NJ) supports space ops
 - **Faraday Technology** (Dayton, OH) develops electrochemical industrial processes
 - **Maxion Technologies** (College Park, MD) produces M/LWIR semiconductor laser sources

PSI has:

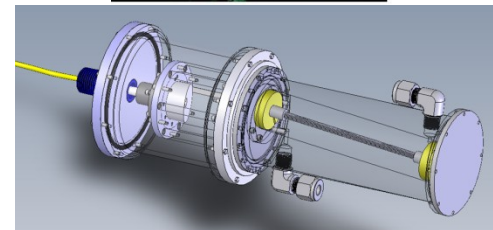
- Spun-out four venture-supported companies
 - **PSI Medical Products**
 - **Spectrum Diagnostix**
 - **Confluent Photonics**
 - **Laser Light Engines**

Leak Detection Product Background

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PSI is a leader in developing and commercializing trace gas sensors and analyzers based on near- and mid-IR Tunable Diode Laser Absorption Spectroscopy (TDLAS)

- **Created Spectrum Diagnostix, Inc. (SDx) in 1992, sold in 1996**
 - Developed the world's first commercial TDLAS products, the SpectraScan® family
 - Collaboration with Petroleum Environmental Research Forum (PERF), including Exxon, Mobil, BP, Shell, Amoco for refinery leak detection
- **Invented, developed and licensed RMLD™**
 - Heath Consultants commercial product released in 2005, R&D 100 Award
- **Conducts advanced TDLAS R&D**
 - > 150 custom TDLAS systems delivered to government and industrial customers
 - *Mid-IR sensors based on Quantum Cascade (QC) and Difference Frequency Generation (DFG) lasers*



Heath Consultants

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- **Heath Consultants, Houston, TX**
- **Founded 1933, 1000 employees**
- **Premier worldwide supplier of natural gas leak detection technology and services.**
- **Partnering with major pipeline distribution companies, Heath provides trusted access to the end-user markets for prototype testing, ergonomic/functional product feedback, and early product adoption.**
- **With PSI, Heath introduced the RMLD™ in 2004. Over 1500 units sold**



Non-Proprietary

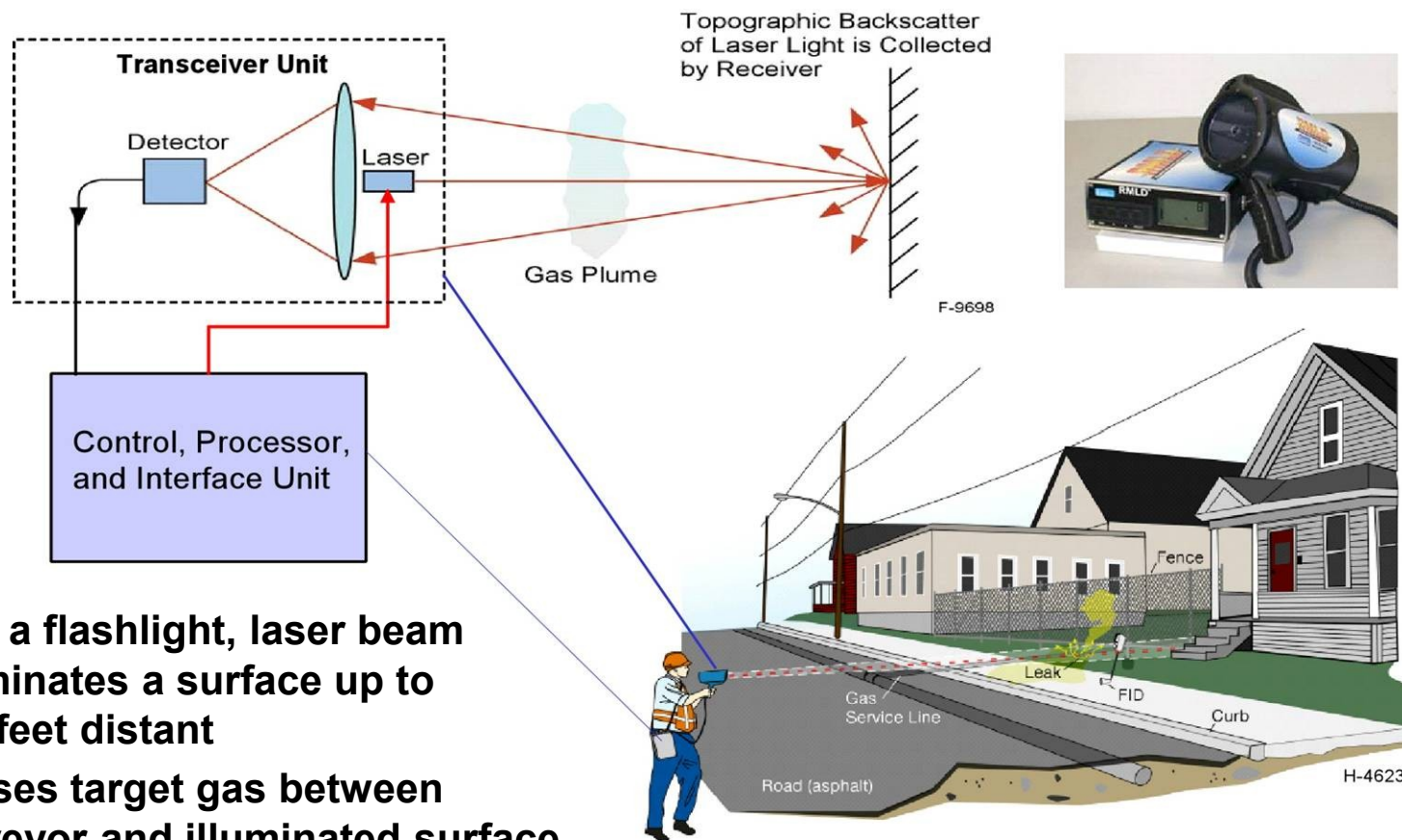
Portable Standoff TDLAS Product:



The Remote Methane Leak Detector (RMLD™)

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- Like a flashlight, laser beam illuminates a surface up to 100 feet distant
- Senses target gas between surveyor and illuminated surface
- *>1500 in use for natural gas (CH₄) distribution pipeline leak surveying*

Non-Proprietary



RMLD™ Derivatives

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- **Aerial**
 - Extended range (>1000 ft) RMLD transceiver
 - Fixed wing and helicopter
 - Low cost compared to other aerial gas sensors
- **RMLD™ Pipeline Monitor**
 - Permanent open-path and miniature point alarms to detect and mitigate potentially explosive leaks
- **Liquid hydrocarbon pipeline leak sensor (Fuelfinder)**
 - DoT-funded R&D in progress
 - Heath Consultants, Morgan-Kinder cost-share partners
 - Maxon Technologies (a PSI Company) collaborator
- **CO₂ sensors**
 - For inspecting and monitoring CO₂ sequestration pipelines

Aerial RMLD™

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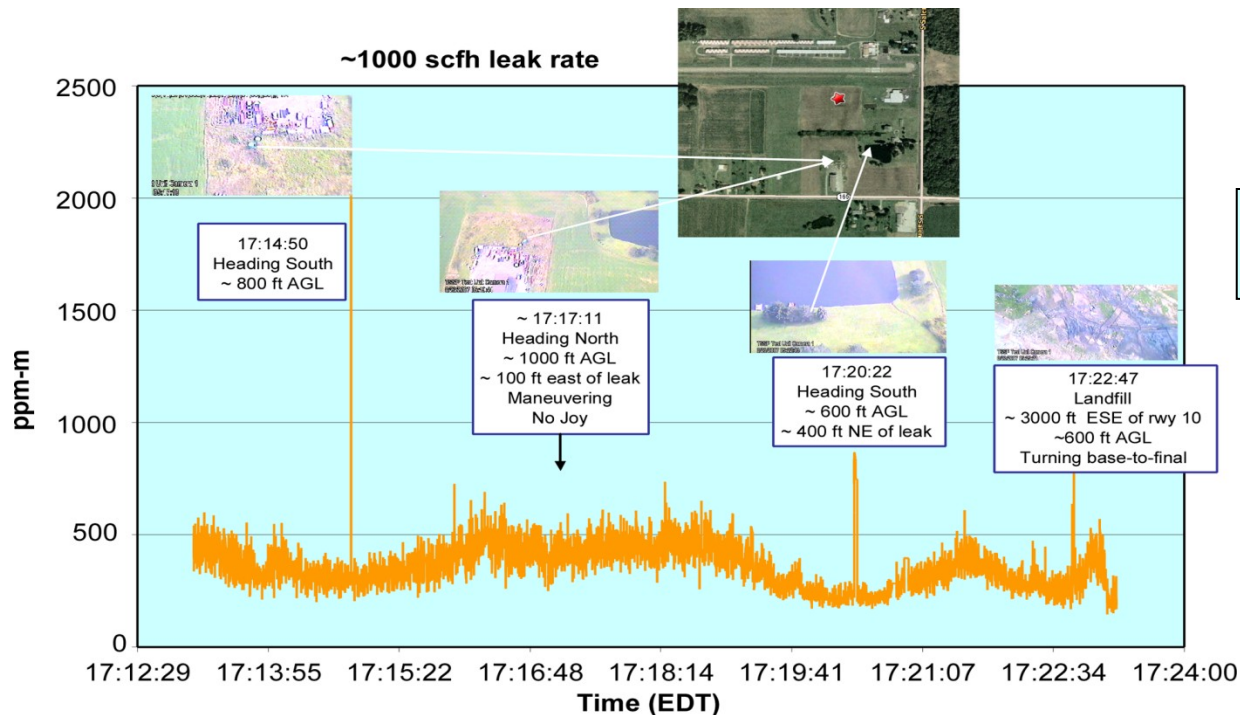
Fixed-wing



Helicopter

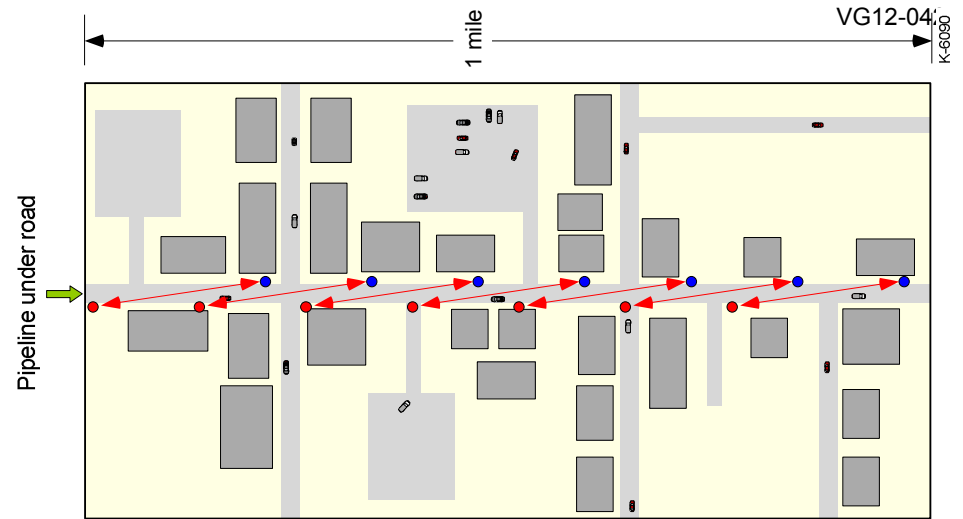
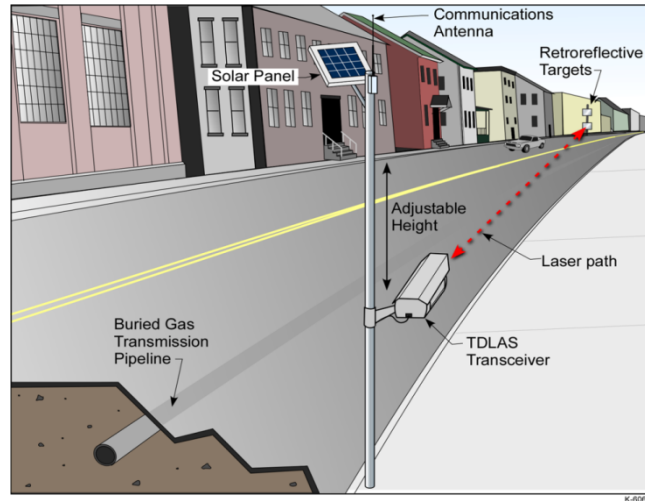


Mini-UAV

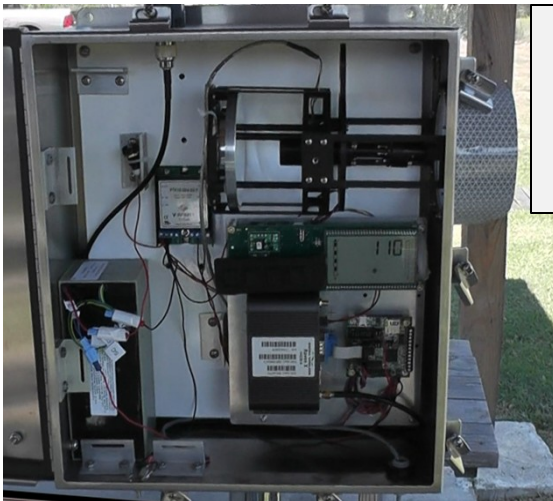


**Leak detection from
fixed-wing aircraft**

RMLD™ Pipeline Monitors



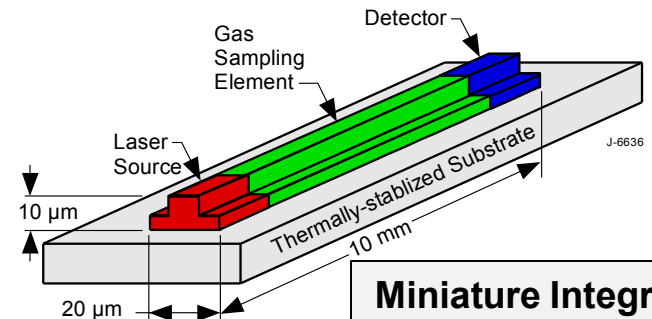
Permanent alarms to rapidly detect and mitigate ruptures



**Open-Path Test Unit
at Heath
Consultants'
Houston facility**



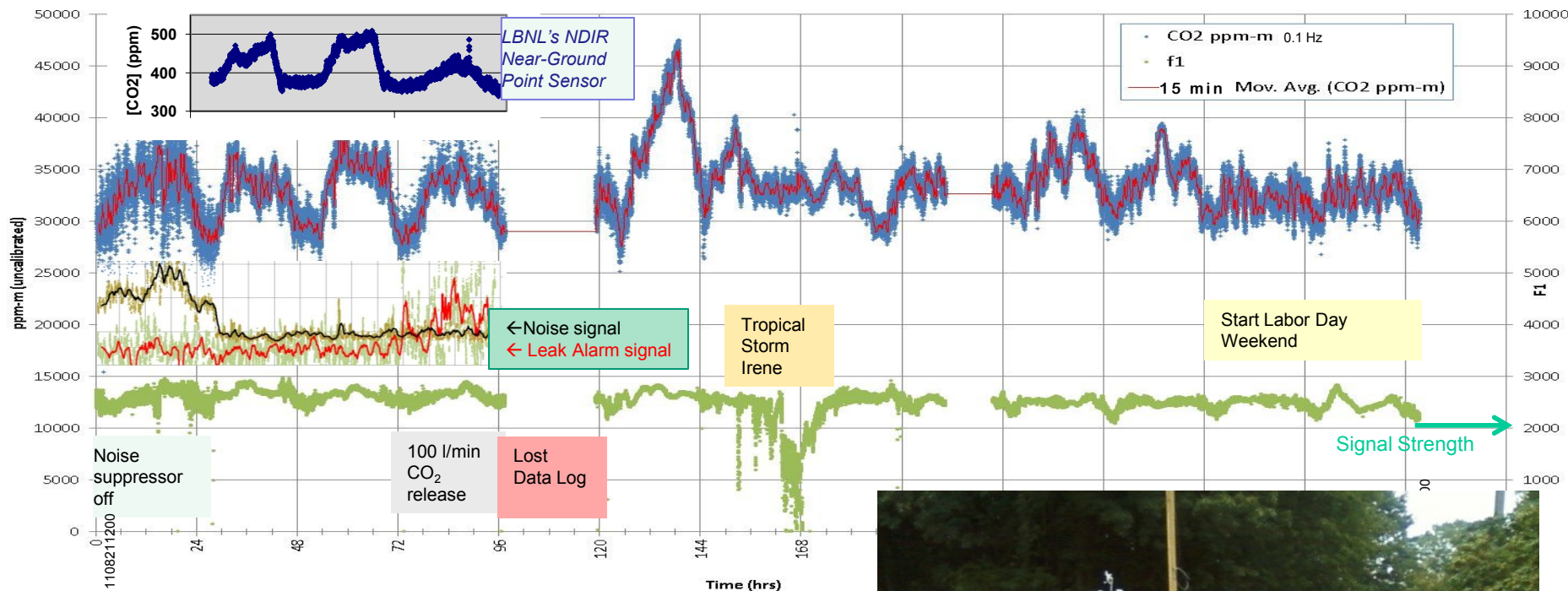
Non-Proprietary



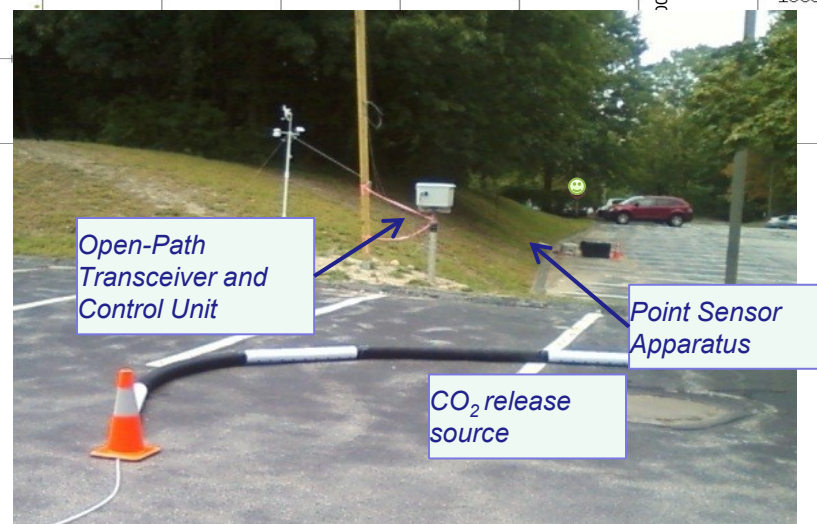
**Miniature Integrated-
Optic Point Sensor
in development at
PSI**

Open-Path CO₂ – PSI site, Andover, MA

August 2011



- **Continuous operation**
 - No adjustment, calibration, or zeroing
- **Diurnal variations correlate with point sensor measurements**
- **Leaking CO₂ yields statistically distinct signature**
 - Rapid fluctuations
 - Excursions skew positive relative to average



- ***Extends RMLD™ platform to liquid hydrocarbon leak detection***
 - Adopts recent advances in room-temperature diode laser technology operating near 3 microns
- **Addresses a industry need for detection of petroleum product leaks from buried pipelines too small for detection by SCADA-type inventory control systems**
 - Secures valuable petroleum product
 - Protects the environment
 - Decreases the time/cost of searching for and repairing buried pipe leaks
- **Project culminates with demonstration of prototype man-portable sensor to detect underground gasoline leaks**